CLAIMS

What is claimed is:

1. A power transmission device comprising:

a rotary input member adapted to receive drive torque from a source of torque;

a rotary output member adapted to provide drive torque to an output device; and

a torque transfer mechanism operable for transferring drive torque from said input member to said output member, said torque transfer mechanism including a friction clutch assembly operably disposed between said input member and said output member and a hydraulic clutch actuation system operable for applying a clutch engagement force to said friction clutch assembly, said hydraulic clutch actuation system including a primary fluid circuit and a separate secondary fluid circuit interconnected by a pressure intensifier, said second fluid circuit including a clutch operator that is selectively engageable with said friction clutch assembly.

2. The power transmission device of claim 1 wherein said friction clutch assembly includes an interleaved clutch pack having a first set of clutch plates fixed for rotation with said input member and a second set of clutch plates fixed for rotation with said output member, and a pressure plate, and wherein axial movement of said clutch operator causes said pressure plate to apply said clutch engagement force on said clutch pack.

3. The power transmission device of claim 1 wherein said input member is a first output shaft of a transfer case and said output member is a second output shaft of said transfer case.

4. The power transmission of claim 1 wherein said input member is driven by a powertrain of a motor vehicle and said output member is connected to a differential of an axle assembly.

5. The power transmission of claim 1 further including a controller to establish the value of an electric control signal based on a rotary speed difference between said input member and said output member, and wherein said control signal is operable to vary the pressure supplied to said clutch operator for causing torque to be transferred by said friction clutch assembly.

6. The power transmission of claim 1 wherein said primary fluid circuit includes a pressure source and a first valve for selectively coupling said pressure source to a first side of said pressure intensifier.

7. The power transmission of claim 6 wherein said secondary fluid circuit includes a first valve for selectively coupling a second side of said pressure intensifier to said clutch operator, said second side of said pressure intensifier operable to output fluid at substantially greater pressures than supplied on said first side of said pressure intensifier.

8. The power transmission of claim 7 wherein said primary circuit includes a second valve for selectively interconnecting said pressure source to an accumulator, said accumulator being positioned between said first valve and said second valve.

9. The power transmission of claim 8 wherein said secondary circuit includes an exhaust valve for selectively coupling a pressure chamber and a reservoir, said exhaust valve operable to release pressure in said pressure chamber, thereby removing said clutch engaging force from said clutch operator.

10. The power transmission of claim 1 further including a second pressure source, said second pressure source operable to provide pressurized lubricant to said friction clutch assembly.

11. The power transmission of claim 10 wherein said second pressure source is powered by an electric motor.

12. The power transmission of claim 10 wherein said second pressure source is provided by a pump selectively driven by said rotary input member.

13. A transfer case for use in a motor vehicle having a powertrain and first and second drivelines, comprising:

a first shaft driven by the powertrain and adapted for connection to the first driveline;

a second shaft adapted for connection to the second driveline;

a torque transfer mechanism operable for transferring drive torque from said first shaft to said second shaft, said torque transfer mechanism including an input member driven by said first shaft, an output member driving said second shaft, a friction clutch assembly operably disposed between said input member and said output member, and a hydraulic clutch actuation system operable for applying a clutch engagement force on said friction clutch assembly, said hydraulic clutch actuation system including a fluid pressure source communicating with an inlet of a pressure intensifier, said pressure intensifier supplying increased fluid pressure from its outlet to a piston chamber, a piston disposed in said piston chamber being operable for applying said clutch engagement force.

14. The transfer case of claim 13 wherein said pressure intensifier includes a low pressure piston in communication with said pressure source and a high pressure piston coupled to said low pressure piston, said high pressure piston placing said increased fluid pressure in communication with said piston chamber, said low pressure piston defining an effective area substantially greater than an effective area of said high pressure piston.

15. The transfer case of claim 13 wherein said fluid pressure source includes an accumulator and a valve in communication with said pressure intensifier.

16. A power transmission device comprising:

a rotary input member adapted to receive drive torque from a source of torque;

a rotary output member adapted to provide drive torque to an output device; and

a torque transfer mechanism operable for transferring drive torque from said input member to said output member, said torque transfer mechanism including a friction clutch assembly operably disposed between said input member and said output member and a hydraulic clutch actuation system operable for applying a clutch engagement force to said friction clutch assembly, said hydraulic clutch actuation system including a primary fluid circuit and a secondary fluid circuit interconnected by a pressure intensifier, said secondary fluid circuit operable in a first mode to apply said clutch engagement force to said friction clutch assembly and a second mode to couple a pump member to a continuously driven member to provide lubrication to said friction clutch assembly.

17. The power transmission device of claim 16 wherein said primary fluid circuit is operable in an apply mode and a release mode and includes a pressure source coupled to a low pressure side of said pressure intensifier in said apply mode, said low pressure side of said pressure intensifier being coupled to a sump in said release mode.

18. The power transmission device of claim 17 wherein said secondary fluid circuit includes a supply line selectively coupling a high pressure side of said pressure intensifier to a piston for supplying said clutch engagement force.

19. The power transmission device of claim 18 wherein said secondary fluid circuit includes a first accumulator for storing highly pressurized fluid supplied when said primary circuit is in said apply mode.

20. The power transmission device of claim 18 wherein said secondary fluid circuit includes a return line selectively coupling said piston to a low pressure reservoir to allow release of said clutch engagement force.

21. The power transmission device of claim 20 wherein said secondary fluid circuit includes a second accumulator for storing low pressure fluid.

22. The power transmission device of claim 16 wherein said second fluid circuit includes a pump piston coupled to a high pressure side of said pressure intensifier, said pump piston being selectively operable to supply pressurized fluid for coupling said pump member to said continuously driven member.

23. The power transmission device of claim 22 further including an electric pump operable to selectively supply fluid to said high pressure side of said pressure intensifier and lubrication to said friction clutch assembly.

24. A method of actuating a clutch in a power transmission device, the method comprising:

selectively supplying a pressurized fluid to a low pressure side of a pressure intensifier;

selectively supplying magnified pressure from a high pressure side of said pressure intensifier to a piston; and

engaging the clutch with said piston to drivingly interconnect two rotary members.

25. The method of claim 24 further including maintaining a desired pressure range within a low pressure accumulator of a primary fluid circuit by selectively coupling a low pressure source to said accumulator.

26. The method of claim 25 wherein the step of maintaining a desired pressure includes supplying a pressure signal from said pressure source to a primary pressure control unit, said primary pressure control unit communicating with a first control valve selectively coupling said low pressure source to said accumulator.

27. The method of claim 25 further including maintaining a desired pressure range in a secondary fluid circuit, said secondary fluid circuit being coupled to said primary circuit by said pressure intensifier.

28. The method of claim 27 wherein the step of maintaining a desired pressure in a secondary fluid circuit includes operating a second control valve of said primary fluid circuit to selectively supply fluid from said low pressure accumulator to said low pressure side of said pressure intensifier.

29. The method of claim 28 wherein the step of supplying magnified pressure to said piston includes receiving a torque request from a controller, comparing the pressure applied to said piston with the pressure available at said high pressure side of said pressure intensifier and modulating a third control valve interconnecting said pressure intensifier and said piston to control the clutch to meet said torque request.

30. The method of claim 24 further including coupling a pump component to a driven shaft of the power transmission device and pumping lubricant on the clutch by said pump component being coupled to said driven shaft by supplying magnified pressure from said high pressure side of said pressure intensifier to a second piston.